89
361
5

U. S. F. W. S. Spec. Scientific Rept. - Fish. LIBRARY

JUL 1 1960

FISH & WILDLIFE SERVICE

D
C
B

#
339

# FISHES TAKEN IN THE MENHADEN FISHERY OF ALABAMA, MISSISSIPPI AND EASTERN LOUISIANA

SPECIAL SCIENTIFIC REPORT–FISHERIES No. 339

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

United States Department of the Interior, Fred A. Seaton, Secretary
Fish and Wildlife Service, Arnie J. Suomela, Commissioner
Bureau of Commercial Fisheries, Donald L. McKernan, Director

# FISHES TAKEN IN THE MENHADEN FISHERY OF ALABAMA MISSISSIPPI, AND EASTERN LOUISIANA

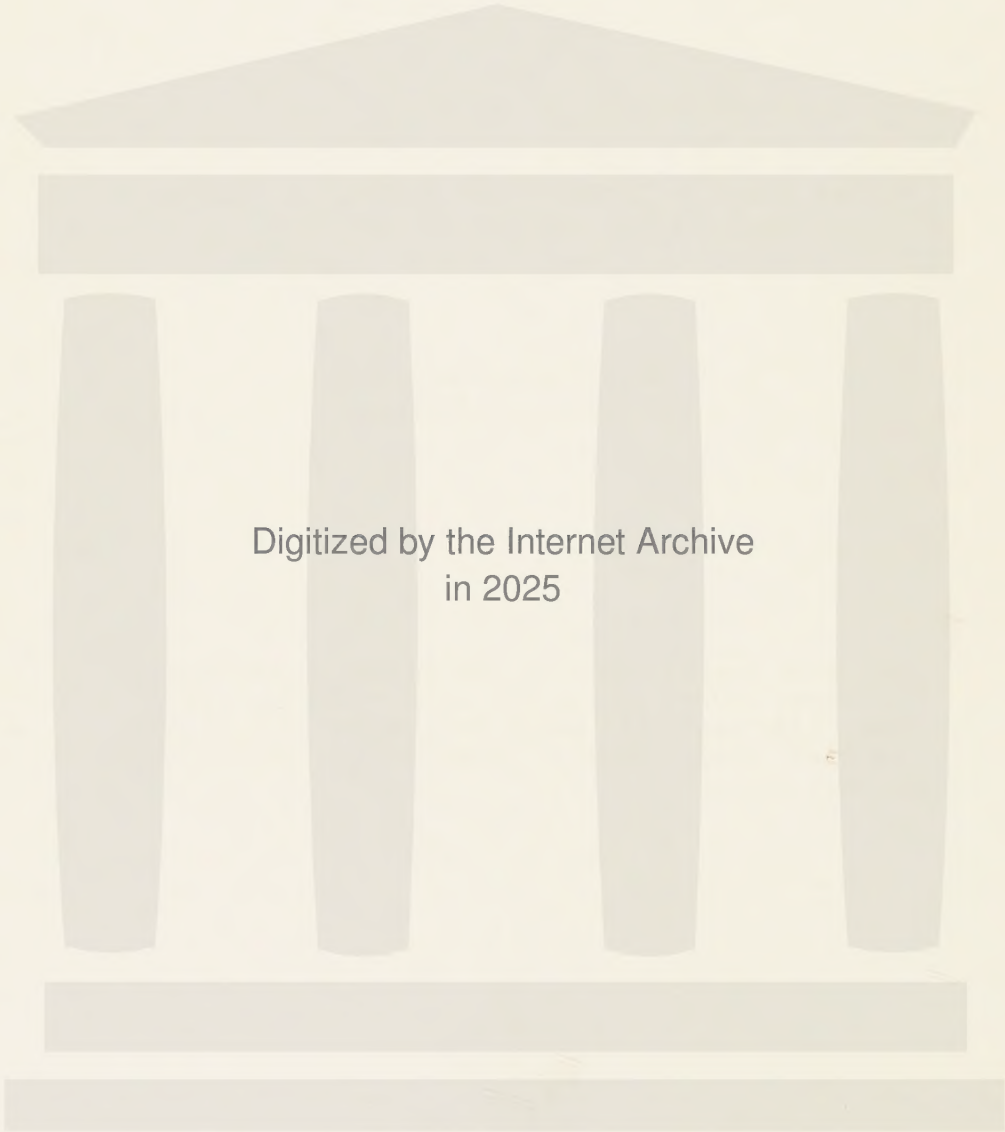
by

J. Y. Christmas, Gordon Gunter
and Edward C. Whatley

This work was financed by the Bureau of Commercial Fisheries under Contract No. 14-19-008-9335, with funds made available under the Act of July 1, 1954 (68 Stat. 376), commonly known as the Saltonstall-Kennedy Act.

United States Fish and Wildlife Service
Special Scientific Report--Fisheries No. 339

Washington, D. C.
April 1960



Digitized by the Internet Archive
in 2025

https://archive.org/details/noaa-technical-report-nmfs-ssrf_1960-04_339

TABLE OF CONTENTS


| | Page |
|---|---|
| Introduction | 1 |
| Sampling the Mississippi purse seine catch | 2 |
| Collection of data | 2 |
| Fishing grounds | 3 |
| Temperature and salinity | 3 |
| Menhaden in the purse seine catch | 4 |
| Other fishes in the purse seine catch | 4 |
| Seasonal variations | 8 |
| Comparison with other studies | 8 |
| Other animals in the purse seine fishery | 9 |
| Summary and conclusions | 9 |
| Literature cited | 9 |

# FISHES TAKEN IN THE MENHADEN FISHERY OF ALABAMA MISSISSIPPI, AND EASTERN LOUISIANA

by

J. Y. Christmas, Gordon Gunter, and
Edward C. Whatley
Gulf Coast Research Laboratory
Ocean Springs, Mississippi

## ABSTRACT

A study was made of the fishes other than menhaden taken by menhaden purse seiners in waters around the mouth of the Mississippi River and in Mississippi Sound during the 1958 and 1959 seasons. Samples were taken from catches which totaled nearly 2 million pounds, the equivalent of one-fifth of one boat's seasonal catch. In numbers of fish, more than 97 percent of the sampled catch were menhaden. The following 10 species, given in order of their abundance, made up over 90 percent of the other fishes caught: Mugil cephalus, Micropogon undulatus, Leiostomus xanthurus, Dorosoma petenense, Bagre marina, Galeichthys felis, Cynoscion arenarius, Poronotus triacanthus, Cynoscion nothus, and Lagodon rhomboides. The preponderance of mullet resulted because sets were made on schools of this species which had been mistaken for menhaden. Otherwise, the mullet was not common in the catches. The estimated annual catch of fishes, other than menhaden, made by the Gulf menhaden fishery is about 15 million pounds per year. The fishery is generally prosecuted in shallow, low-salinity waters. Seventy percent of the sampled menhaden catches were made in waters of salinities between 5 and 24 parts per thousand.

## INTRODUCTION

Commercial fishing for menhaden in Gulf of Mexico is carried on with purse seines by approximately 60 vessels operating from Mississippi, Louisiana, and Texas ports. Over 500 million pounds of menhaden, mostly Brevoortia patronus, are caught each year between April and October. This is the largest fishery of the Gulf, and occasionally concern has been expressed about the numbers and kinds of other fishes caught along with menhaden. The purpose of this study was to determine the catch composition of landings at Mississippi ports. Most of these catches were made in Louisiana and Mississippi waters, with a few from Alabama.

Two other extensive studies of this subject have been made. One concerned the Atlantic menhaden fishery, and the other the northwestern Gulf of Mexico. In 1894 the U. S. Fish Commission instructed two agents to record the quantity of menhaden and "the number of each other kind of fish taken" on two menhaden vessels fishing out of Connecticut and Virginia ports (Smith 1896). The total catch of the two vessels was "27,965,755 menhaden". The report does not indicate how these numbers or the 94,795 other fishes recorded in the catch were determined. Sixty-two species other than menhaden were reported. Fishes of the genus "Clupea (pseudoharengus, aestivalis, sapidissima, and mediocris)" accounted for 93.5 percent of the other fishes. Approximately 97 percent of the clupeids were alewives, nearly all being taken on the New England coast by one vessel. About half of these were obtained in one haul in Boston Harbor. A number of large schools of alewives were released after their identity was discovered. These were not included in the count of other fishes. The 1,816 shad (Clupea sapidissima) were taken under similar conditions, nearly all being obtained in three hauls in July at the mouth of the Kennebec River, Maine. Bluefish (Pomatomus saltatrix) made up 2.4 percent of the catch. The remaining 4.1 percent was divided among 58 species.

Seven species were represented by single specimens.

Miles and Simmons (1950) included lists of other fishes taken in the menhaden purse-seine vessels of Port Arthur, Texas, in 1948 and 1949. These boats worked off the western coast of Louisiana. Altogether 2,183 other fishes were taken with 2,500,000 menhaden in 59 hauls observed in 1948. Fifteen species and six groups such as "flat-fishes, croakers, herring-like fishes" were not specifically identified. The herring-like fishes accounted for 68.7 percent of the fishes other than menhaden. Harvest-fish, Peprilus paru, made up 5.4 percent of the count, and 4.9 percent were Spanish mackerel, Scomberomorus maculatus. Six additional species and "groups" comprised 15.7 percent, and the remaining 5.3 percent consisted of 12 species and groups. In 1949, observations covered 143 sets taking 5,326,000 menhaden and 7,309 other fishes. The bumper, Chloroscombrus chrysurus, and thread herring, Opisthonema oglinum, accounted for 50.4 and 20.3 percent of the other fishes. Seven species accounted for an additional 23.7 percent, with the remaining 5.6 percent distributed over 34 species. Seven of these were represented by single specimens. Five genera were not listed by species. The 1948 study included 5 species not listed in the 1949 count of other fishes. Comparison of the two annual lists is difficult because "groups" rather than species were listed in several instances. Some part of the data given by Miles and Simmons (1950) were also reported by Knapp (1950).

In response to a request for information regarding his methods of collecting data, Mr. Ernest G. Simmons (personal communication) has given us the following information:

"In the 1948 menhaden work the counts of menhaden were assumed to be units of fish. ... the average number of fish per basket on the conveyor belt was determined by actual count and then the total number of baskets was obtained to give the total number of fish.

"When the fish were brought aboard ... I ... counted fish other then menhaden. ... each brail of about five thousand fish spread out in an even layer over the fish already in the hold. Then with the aid of a long-handled dip net I could secure the fish. In most instances ... the crew grabbed every eatable fish as it came aboard. Checks at the dock ... indicated that all fish except clupeids had been removed."

## SAMPLING THE MISSISSIPPI PURSE-SEINE CATCH

A study of the purse-seine catch brought to Mississippi processing plants was started in June 1958 and completed in May 1959. Biologists made trips with commercial vessels during each month of the fishing season except September 1958. In 26 days of fishing, 89 sets produced an estimated catch of 2,977,500 "fish" 1/ or 1,985,000 pounds. The equivalent of approximately 20 percent of the seasonal catch of one boat was sampled. In 1958, samples were taken from 15 sets in June, 19 in July, 16 in August and 12 in October; in May 1959, 27 sets were sampled.

### Collection of Data

Location, time, weather conditions, and water depth were recorded when the net was set. As the menhaden vessel came alongside the purse boats, surface water temperature was measured and a water sample was drawn for salinity determination. Samples of the catch were taken from the chutes as the fish were pumped aboard. Approximately equal portions from the beginning, the middle, and the end of the pumping operation made up the sample. All species observed in the net and during the pumping operation were recorded. Specimens other than menhaden were often taken from the purse seine with a gaff or dip net and when necessary were brought back to the laboratory for positive identification.

Counts of each species in the sample were made after pumping was completed. Parasite counts, fork lengths, and various other measurements and observations com-

---

1/ Menhaden operators have a unit of measure called a quarter box which contains a thousand standard menhaden (a fish occupying 22 cubic inches). Actually, fish in the box are packed so tightly that regardless of actual sizes the total weight always approaches 660 pounds. Thus the fishermen have come to speak of a "fish" as a unit which weighs 2/3 of a pound. When used in that sense in this report the word is set off in quotes.

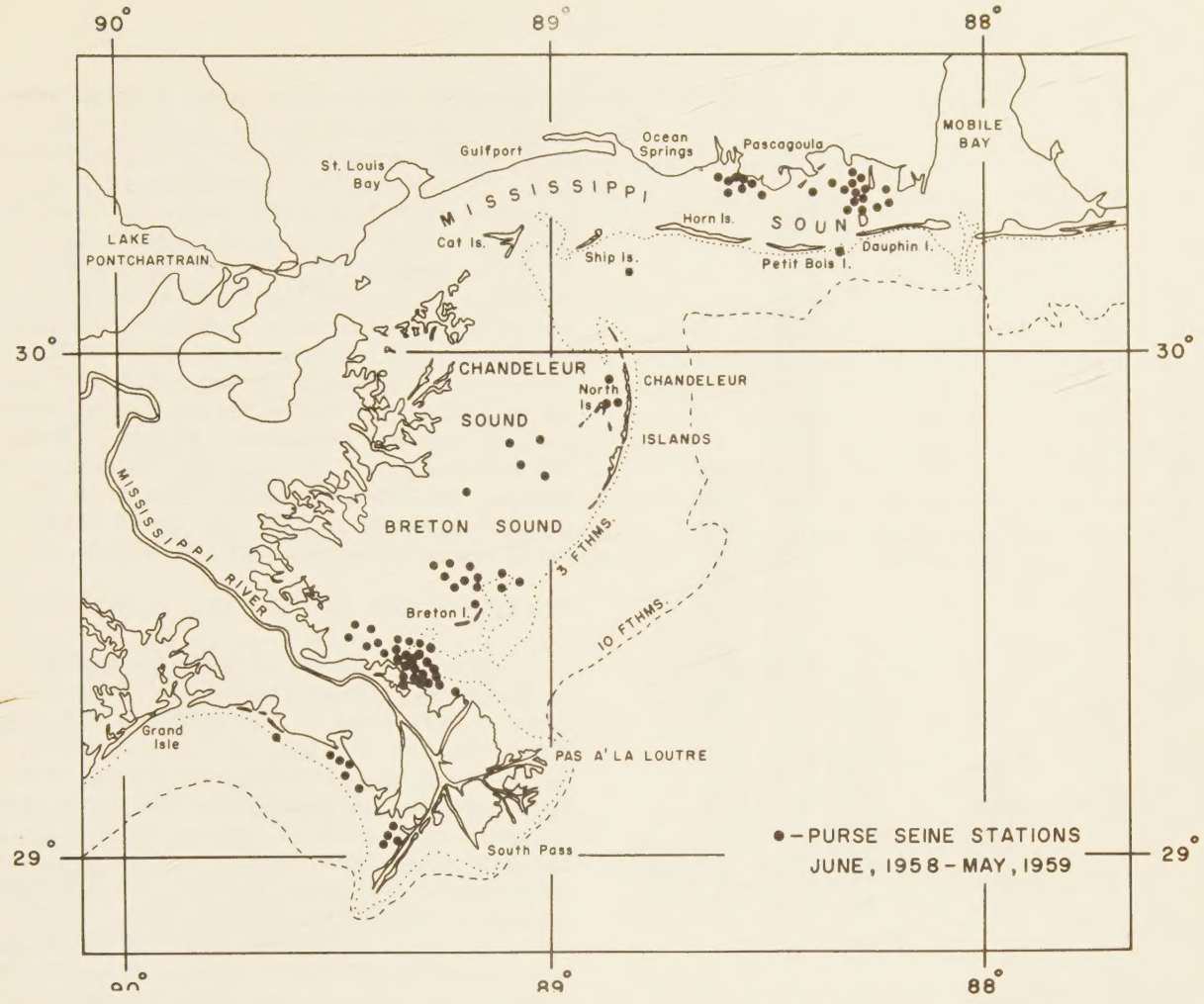



Figure 1. --Catches sampled in the menhaden purse seine fishery 1958-59.

pleted the work with each sample. The catch was estimated by experienced personnel. These estimates were compared with the measurement by mechancial devices at the factory on unloading and were found to be conservative but reasonably accurate.

## Fishing Grounds

Menhaden purse seiners start fishing about mid-April and complete the local season by October 15, or shortly thereafter. Practically all fishing observed in this study was in inshore waters where depths seldom exceed 3 fathoms. Breton, Chandeleur, and Mississippi Sounds were the chief areas fished from June through October in 1958. Late in the season some fish were taken in Gulf waters off these areas. The 1959 season started in April in Breton Sound. During the last week of May the boats moved west of the Mississippi delta where conditions are essentially the same as those in the sound areas to the east. A heavy run of fish occurred from Grand Isle to West Bay and produced excellent catches. Figure 1 shows the location of sets observed in this study.

## TEMPERATURE AND SALINITY

Surface water temperatures showed a minimum of 22.6° C. and a maximum of 30.5° C. The lowest temperatures occurred at the beginning and end of the season. The average water temperature at the last five sets in 1958 was 23.7° C. The temperatures at the first five stations in 1959 were not recorded. The mean temperature at five stations taken May 11 and 13, 1959, was 23.9° C.

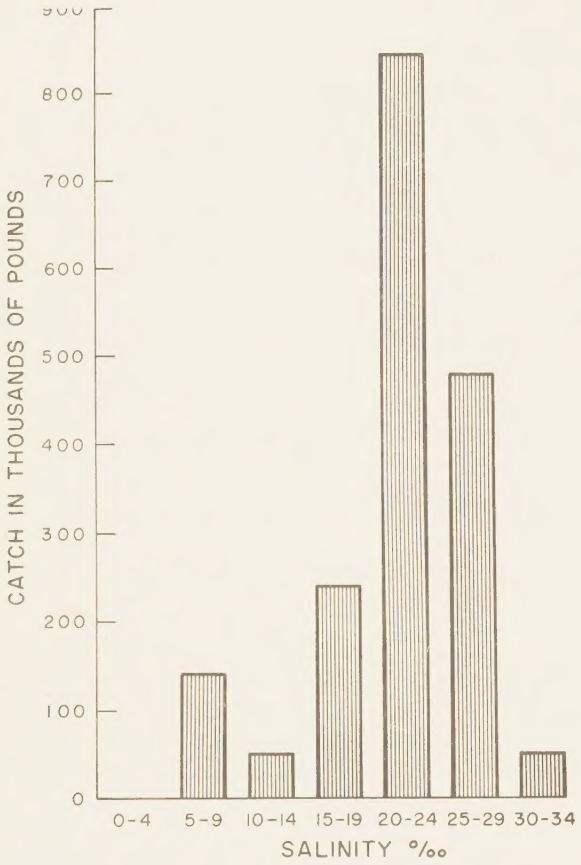



Figure 2.--Distribution of Mississippi menhaden catch in salinity ranges, 1958-59.

Salinities ranged from 6.15 °/oo (parts per thousand) to 31.58 °/oo. Of the 84 samples, 58 percent showed salinities of 20 °/oo to 24 °/oo, and 88 percent were in a range from 15 °/oo to 29 °/oo. Figure 2 illustrates the distribution of the catch in relation to salinity.

## MENHADEN IN THE PURSE SEINE CATCH

Brevoortia patronus ranges from Tampa, Fla., to Brazos Santiago, Tex. (Hildebrand 1948), and makes up practically the entire Gulf menhaden catch. A few specimens of the two other Gulf species, B. gunteri and B. smithi, have been taken by boats operating out of Mississippi ports, but none were observed during this study.

Samples from the purse-seine catches included 55,949 fishes, of which 96.1 percent were menhaden, counting each haul of equal value (table 1). When samples were weighted according to the size of each haul, 97.2 percent of the catch was menhaden. Twelve samples containing only B. patronus were drawn from hauls of 5 to 75 thousand "fish" with an average catch of 50.8 thousand units. Other species were observed in the net in 10 of these hauls. The large hauls usually contained a higher percentage of menhaden than small hauls. Seventy-five percent of the catch was taken in 50 percent of the hauls, and contained over 99 percent menhaden. Figure 3 shows the percentage of B. patronus in each set, except for five which were less than 90 percent menhaden. Three of these five hauls took 5,000 or fewer "fish."

## OTHER FISHES IN THE PURSE SEINE CATCH

The list of other fishes observed includes 62 species (table 2). Twenty-two species were seen in the nets but did not appear in the samples; of these species, nine were seen only once, five were seen in two sets, and eight occurred three times or more. The anchovy, Anchoa mitchilli, and the silverside, Membras martinica, are numerous in the areas fished, but are small enough to escape through the net. Eight species are usually too large to enter the pumps used to unload the net. One jewfish, Promicrops itaiara, estimated to weigh 300-350 pounds was taken from the net on May 29, 1959, near Sandy Point, La. Fishermen recalled having taken several others in their years of fishing. One tarpon, Megalops atlanticus, was taken in Mississippi Sound off the west end of Dauphin Island on August 20, 1958. Tarpon are occasionally surrounded by the net but usually escape.

Five species of sharks, the bull shark (Carcharhinus leucas), sharp-nose shark (Scoliodon terrae-novae), black-tipped shark (Carcharhinus limbatus), hammerhead (Sphyrna diplana) and bonnet head shark (Sphyrna tiburo), were seen in the net. This list is probably incomplete, for sharks were seen but not identified in 11 sets. Of the 88 sets, 22 included sharks. The crews made every effort to prevent sharks from reaching the pump while loading. They were either gaffed from the deck and dropped outside the net or picked up from the purse boat. Consequently, many specimens could not be seen close enough for identification. Jacks, Caranx hippos, were seen in 20 hauls.

Table 1.--Percentage of menhaden in the Mississippi purse seine catches 1/

| Period | No. sets | Thousands of pounds | | % B. patronus in samples | | |
|---|---|---|---|---|---|---|
| | | Est. Catch | Ave. haul | Mean | Min. | Max. |
| 6/23-26/58 | 15 | 353.6 | 23.6 | 92.0 | 45.9 | 100.0 |
| 7/7-11/58 | 19 | 174.7 | 9.2 | 90.5 | 0.6 | 100.0 |
| 8/18-22/58 | 16 | 292.6 | 18.3 | 97.6 | 90.4 | 100.0 |
| 10/9-14/58 | 7 | 98.0 | 14.0 | 98.8 | 97.6 | 99.4 |
| 10/20-21/58 | 5 | 54.7 | 10.9 | 99.5 | 98.5 | 100.0 |
| 5/1-13/59 | 15 | 620.0 | 41.3 | 99.6 | 98.7 | 100.0 |
| 5/26-28/59 | 12 | 391.3 | 32.6 | 91.9 | 48.9 | 100.0 |

1/ The catch estimates were made by boat captains and were found to check closely with measured weights unloaded at port. The 3 columns to the right give the percentages by number in the samples.

Jacks and sharks were handled by the fishermen in the same way except that jacks were not killed deliberately, as sharks usually were.

Twelve species observed in the nets but not found in the samples were not abundant in the catches. The cowfish (Acanthostracion quadricornis), ocellated fluke (Ancylopsetta quadrocellatus), pig fish (Orthopristes chrysopterus), and southern lake (Urophycis floridanus) were observed only once; shark remora (Echenaucrates), sea robin (Prionotus sp.), butterfly ray (Pteroplatea micrura), and cow-nose ray (Rhinoptera quadriloba) were seen twice; and sheepshead (Archosargus probatocephalus) was found in three sets. Tonguefish (Symphurus plagiusa) gilled in the net four times. Southern flounders (Paralichthys lethostigma) and spiny box fishes (Chilomycterus schoepfi) were observed on five occasions.

Thirty-six specimens of 13 species were seen only in the samples and were not otherwise observed. The numbers per species ranged from 1 to 9. Six of these species were represented by one specimen each; the other 7 species were represented by 31 specimens. Twenty-seven species which occurred in samples and which were also observed in the nets account for 98.3 percent of the 2,179 fishes other than menhaden counted in the samples.

The striped mullet, Mugil cephalus, accounted for 41.4 percent of the count of other fishes taken, but was found at only six stations. One set accounted for 869 of the 902 mullet in the samples. On July 11 off Bird Island in Breton Sound, the spotter plane pilot led the boat to a large school of mullet that had been mistaken for menhaden. Samples from this haul of 30,000 "fish" were 98.4 percent mullet. Numerous large schools of this species were in the area and were avoided by the purse seiners when recognized. Twenty-five percent of the other fishes in

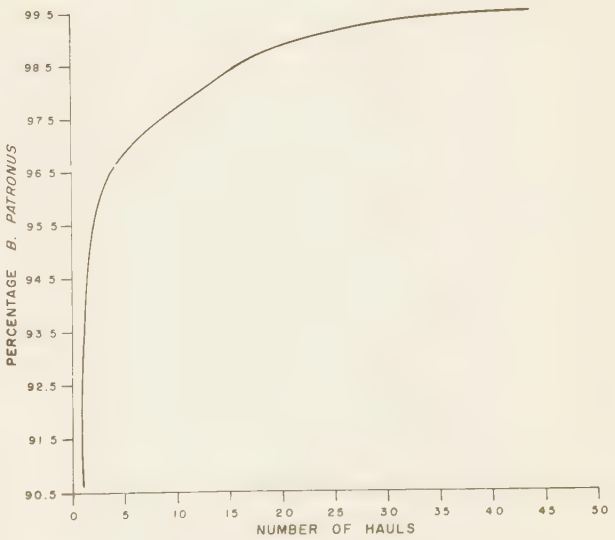



Figure 3.--Percentage of menhaden in purse seine hauls, 1958-59.

Table 2.--Fishes other than Brevoortia found in the Mississippi purse seine fishery, 1958-1959 1/

| Species | Occurrence in Samples | | Observed in net | Total occurrence |
|---|---|---|---|---|
| | Number Samples | Number Specimens | Number Sets | Number Sets |
| 1. Mugil cephalus, striped mullet | 4 | 902 | 3 | 6 |
| 2. Micropogon undulatus, croaker | 32 | 342 | 19 | 39 |
| 3. Leiostomus xanthurus, spot | 38 | 203 | 9 | 43 |
| 4. Dorosoma petenense, gizzard shad | 17 | 155 | 1 | 18 |
| 5. Bagre marina, gafftopsail | 25 | 85 | 43 | 46 |
| 6. Galeichthys felis, hardhead catfish | 18 | 83 | 10 | 24 |
| 7. Cynoscion arenarius, white trout | 15 | 83 | 8 | 22 |
| 8. Poronotus triacanthus, butterfish | 25 | 73 | 1 | 26 |
| 9. Cynoscion nothus, sand trout | 12 | 70 | 3 | 14 |
| 10. Lagodon rhomboides, pinfish | 2 | 23 | 1 | 2 |
| 11. Bairdiella chrysurus, silver perch | 8 | 18 | 2 | 10 |
| 12. Menticirrhus americanus, king whiting | 2 | 18 | 2 | 4 |
| 13. Opisthonema oglinum, threadfin herring | 6 | 15 | 2 | 8 |
| 14. Trichiurus lepturus, cutlass fish | 9 | 13 | 17 | 23 |
| 15. Etropus microstomus, smallmouth flounder | 5 | 11 | 1 | 6 |
| 16. Mugil curema, silver mullet | 4 | 10 | 1 | 4 |
| 17. Menticirrhus littoralis, surf whiting | 3 | 10 | 2 | 4 |
| 18. Chaetodipterus faber, spade fish | 2 | 9 | 0 | 2 |
| 19. Harengula pensacolae, razor belly | 5 | 7 | 0 | 5 |
| 20. Cynoscion nebulosus, spotted sea trout | 3 | 7 | 4 | 6 |
| 21. Polydactylus octonemus, eight-fingered threadfin | 5 | 6 | 0 | 5 |
| 22. Scomberomorus maculatus, Spanish mackerel | 5 | 5 | 26 | 29 |
| 23. Trinectes maculatus, hog choker | 3 | 4 | 4 | 7 |
| 24. Citharichthys spilopterus, spot-finned whiff | 3 | 3 | 0 | 3 |
| 25. Pomatomus saltatrix, bluefish | 3 | 3 | 4 | 7 |
| 26. Dasyatis sabina, stingaree | 2 | 2 | 3 | 4 |
| 27. Dorosoma cepedianum, gizzard shad | 2 | 2 | 0 | 2 |
| 28. Peprilus paru, harvest fish | 2 | 2 | 6 | 8 |
| 29. Selene vomer, lookdown | 2 | 2 | 0 | 2 |
| 30. Vomer setapinnis, moonfish | 2 | 2 | 2 | 3 |
| 31. Syacium gunteri, Gunter's flounder | 1 | 2 | 0 | 1 |
| 32. Chloroscombrus chrysurus, bumper | 1 | 1 | 0 | 1 |
| 33. Hippocampus hudsonius, sea horse | 1 | 1 | 0 | 1 |

Table 2.--Fishes other than Brevoortia found in the Mississippi purse seine fishery, 1958-1959 (Cont'd.)

| Species | Occurrence in Samples | | Observed in net | Total occurrence |
|---|---|---|---|---|
| | Number Samples | Number Specimens | Number Sets | Number Sets |
| 34. Menticirrhus focaliger, Gulf whiting | 1 | 1 | 0 | 1 |
| 35. Oligoplites saurus, leatherjacket | 1 | 1 | 1 | 2 |
| 36. Opsanus beta, toad fish | 1 | 1 | 0 | 1 |
| 37. Prionotus tribulus, southern sea robin | 1 | 1 | 0 | 1 |
| 38. Raja texana, Texas clearnose skate | 1 | 1 | 1 | 2 |
| 39. Stellifer lanceolatus, star drum | 1 | 1 | 0 | 1 |
| 40. Anchoa hepsetus, striped anchovy | 1 | 1 | 1 | 2 |
| 41. Caranx hippos, jack crevalle | 0 | 0 | 20 | 20 |
| 42. Sphyrna tiburo, bonnethead shark | 0 | 0 | 8 | 8 |
| 43. Chilomycterus schoepfi, spiny boxfish | 0 | 0 | 6 | 6 |
| 44. Carcharhinus limbatus, small black-tipped shark | 0 | 0 | 5 | 5 |
| 45. Sphyrna diplana, hammerhead shark | 0 | 0 | 5 | 5 |
| 46. Paralichthys lethostigmus, southern flounder | 0 | 0 | 5 | 5 |
| 47. Symphurus plagiusa, tonguefish | 0 | 0 | 4 | 4 |
| 48. Archosargus probatocephalus, sheepshead | 0 | 0 | 3 | 3 |
| 49. Echeneis naucrates, shark remora | 0 | 0 | 2 | 2 |
| 50. Prionotus sp., sea robin | 0 | 0 | 2 | 2 |
| 51. Pteroplatea micrura, butterfly ray | 0 | 0 | 2 | 2 |
| 52. Rhinoptera quadroloba, cow-nose ray | 0 | 0 | 2 | 2 |
| 53. Scoliodon terrae-novae, sharp nose shark | 0 | 0 | 2 | 2 |
| 54. Acanthostracion quadricornis, cowfish | 0 | 0 | 1 | 1 |
| 55. Anchoa mitchilli, common anchovy | 0 | 0 | 1 | 1 |
| 56. Ancylopsetta quadrocellata, ocellated fluke | 0 | 0 | 1 | 1 |
| 57. Carcharhinus leucas, bull shark | 0 | 0 | 1 | 1 |
| 58. Membras martinica, rough silverside | 0 | 0 | 1 | 1 |
| 59. Orthopristes chrysopterus, pig fish | 0 | 0 | 1 | 1 |
| 60. Promicrops itaiara, jewfish | 0 | 0 | 1 | 1 |
| 61. Megalops atlanticus, tarpon | 0 | 0 | 1 | 1 |
| 62. Urophycis floridanus, southern hake | 0 | 0 | 1 | 1 |

1/ Table 2 has been arranged in the order of abundance of specimens counted in the samples. The number of sets in which each species was observed in the net but did not appear in the samples is listed in the third column. The fourth column, "total occurrence," gives the number of different sets in which each species appeared.

the samples were spot, Leiostomus xanthurus, and croaker, Micropogon undulatus. L. xanthurus was recorded from more sets and samples than M. undulatus, but the count of the latter was higher.

The gizzard shad, Dorosoma petenense, was fifth in order of abundance, although it appeared in fewer sets than the butterfish, Poronotus triacanthus, the cutlass fish, Trichiurus lepturus, the sand trout, Cynoscion arenarius, and the catfish, Galeichthys felis. The gafftopsail, Bagre marina, was recorded from 56 stations and occurred in 25 samples. The 85 gafftopsails in the samples are only 3.9 percent of the count of other fishes, but the many specimens were removed from the net for use as food and were not counted. The Gulf sand trout, Cynoscion nothus, was ninth in numbers counted. The 10 most numerous fishes in the sample accounted for 92.2 percent of the species other than menhaden.

Spanish mackerel, Scomberomorus maculatus, was recorded from 29 stations. When spanish mackerel are in the net, they are readily observed swimming near the surface. Few escape the crew to be picked up by the pumps. Only five samples contained mackerel, although they were observed in 26 sets. The anchovy, Anchoa hepsetus, the leatherjacket, Oligoplites saurus, and the skate, Raja texana, were represented by single specimens. The yellowtail, Bairdiella chrysurus, was found at 10 stations, the threadfin, Opisthonema oglinum, and the harvestifish, Peprilus paru, at eight stations, and the sole, Trinectes maculatus, and the bluefish, Pomatomus saltatrix, at seven stations. The speckled trout, Cynoscion nebulosus, and the flounder, Citharichthys microstomus, were taken six times. Twenty-three pinfish, Lagodon rhomboides, were taken from 2 samples. The tripletail, Lobotes surinamensis, although not observed in this study, was observed in a purse seine on June 19, 1957, and has been included in our list.

## Seasonal Variations

The percentage of fishes, other than menhaden, in the purse-seine catch increased in summer. The abundance of other

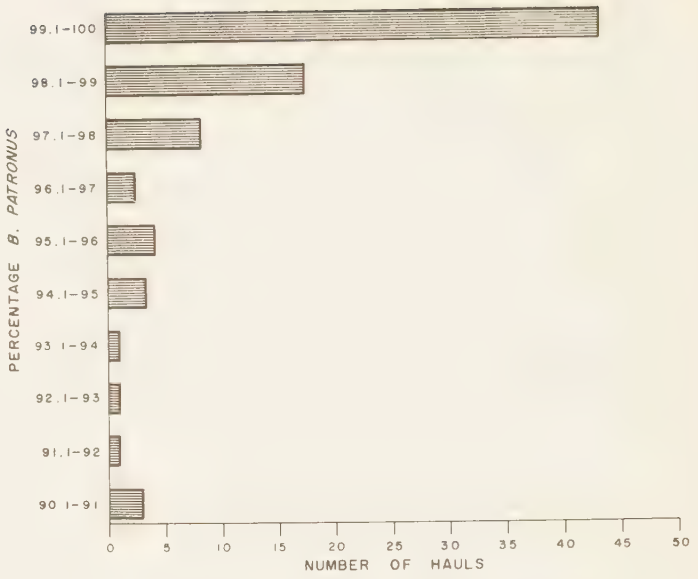



Figure 4.--Percentage of samples from purse seine hauls containing over 90 percent menhaden, 1958-59.

fishes in June and July, with and without two hauls that may have biased results, is shown in figure 4. On June 23, 1958, a haul of 50,000 "fish" showed 54.1 percent other fishes in the sample. Seventy-six percent of the fishes other than menhaden were croakers; white trout, spot, spadefish, and butterfish made up the remainder. Another set was made on a school of mullet in July. In either case the curve of seasonal abundance in the samples corresponds to a previously observed influx of fishes in low-salinity areas as temperatures increase and their exodus with falling temperatures (Gunter 1936,1945).

## COMPARISON WITH OTHER STUDIES

Thirty-six of the species recorded in this study are not reported by Miles and Simmons (1950). The Port Arthur studies include 17 species not listed in our records. Usually, the species not found in both studies represent a small part of the catches. Mugil cephalus in the Mississippi study is the outstanding exception. The most abundant fish other than menhaden differed in western Louisiana and in this study. Miles and Simmons (1950) said the "herring-like" fishes were most abundant, somewhat similar to the report of Smith (1896). We found mullet and two species of croakers to be the most abundant. Miles and Simmons gave no indication that their "herring-like" fishes were taken by mistake.

On the other hand, the most abundant unwanted fish notes in this study, the mullet, was taken inadvertently, similarly to the alewives reported by Smith (1896).

The percentage of other fishes taken in the purse-seine catch for Mississippi is considerably greater than that recorded in earlier studies. This may be the result of different methods of sampling. In 1948 and 1949 fish were brailed from the purse seine; in the present study the fish were removed by suction pumps. Smith (1896) reported only 94,795 fishes among almost 28,000,000 menhaden or approximately 0.3 percent other fishes. The figures reported by Miles and Simmons (1950) from western Louisiana waters were 7,826,000 menhaden and 9,492 other fishes, or about 0.1 percent. Counts during the present study totaled 2,179 other fishes and 53,770 menhaden, or 96.1 percent menhaden and 3.9 percent other fish. When weighted by haul size, 97.2 percent were menhaden. This is a more meaningful percentage.

## OTHER ANIMALS IN THE PURSE SEINE FISHERY

Seventy-two invertebrates of various species were counted in the samples. One valve of a freshly killed Arca sp. was recorded on July 11, 1958, in Breton Sound. The squid, Lolliguculus brevis, was present in one sample and was observed once in the net. The ornate crab, Callinectes ornatus, was recorded from five stations; 10 specimens were counted in four samples. The blue crab, Callinectes sapidus, the most common invertebrate, was recorded from 17 stations, 25 specimens counted from 11 samples. The hermit crabs, Clibanarius sp. and Pagurus sp., and the stone crab, Menippe mercenaria, each appeared at one station. Large specimens of the brown shrimp, Penaeus aztecus, were recorded at 17 stations. Twenty-three specimens were counted in 11 samples. The white shrimp, Panaeus setiferus, occurred at eight stations, and 10 specimens were counted from five samples. Echinoderms were represented by one specimen of Luidia clathrata, seen hanging in the net, and one unidentified holothurian. The bottlenose dolphin, Tursiops truncatus, was common on the fishing grounds. On August 19, 1958, in Mississippi Sound five dolphins were surrounded by the net on one set. Two of these went through the net, leaving holes that required mending, and three were rolled over the cork line by the crew.

## SUMMARY AND CONCLUSIONS

The Mississippi purse-seine fishery is carried on in shallow, low-salinity water. Nets nearly always reach the bottom; consequently rough bottom must be avoided to prevent extensive damage to gear.

The list of fishes other than menhaden recorded from the Gulf purse-seine fishery comprised 80 species, including those listed from western Louisiana waters by previous workers. In the present study, over 90 percent of all fishes other than menhaden are included in 10 species. These are Mugil cephalus, Micropogon undulatus, Leiostomus xanthurus, Dorosoma petenense, Bagre marina, Galeichthys felis, Cynoscion arenarius, Poronotus triacanthus, Cynoscion nothus, and Lagodon rhomboides. Similar results were obtained in earlier studies in western Louisiana waters, but the dominant species varied.

Although the figures indicate that the percentage of fishes other than menhaden in the Mississippi fishery is greater than shown by investigations of the Port Arthur fishery in 1948 and 1949, the difference may be due to sampling method, or to the effects of fishing in shallow water. Approximately 3 percent of the purse-seine catches are fishes other than menhaden; largely striped mullet and croaker. The number of invertebrates taken is negligible.

## LITERATURE CITED

GUNTER, GORDON.

1936. Studies of the destruction of marine fish by shrimp trawlers in Louisiana. Louisiana Conservation Review, vol. 5, No. 4, pp. 18-24, 45-46.

1945. Studies on marine fishes of Texas. Publications of the Institute of Marine Science, vol. 1, No. 1, 190 pp.

HILDEBRAND, SAMUEL F.
1948. A review of the American menhaden genus Brevoortia, with a description of a new species. Smithsonian Miscellaneous Collections, vol. 107, No. 18, pp. 1-39.

KNAPP, FRANK T.
1950. Menhaden utilization in relation to the conservation of food and game fishes of the Texas Gulf coast. Transactions of American Fisheries Society, vol. 79, pp. 137-144.

MILES, DEWEY W., AND ERNEST G. SIMMONS.
1950. The menhaden fishery. Marine Laboratory Series II, Bulletin Texas Game, Fish and Oyster Commission, pp. 1-28.

SMITH, HUGH M.
1896. Notes on an investigation of the menhaden fishery in 1894, with special reference to the food fishes taken. Bulletin U. S. Fish Commission, vol. 15 (1895), pp. 285-302.



INT.DUP.,D.C.60- 73211